

Leveraging NASA's Digital Transformation to Transform R&M and SMA Activities

RAMS Advisory Panel 2022

PRESENTED BY: Tony DiVenti, NASA R&M Technical Fellow



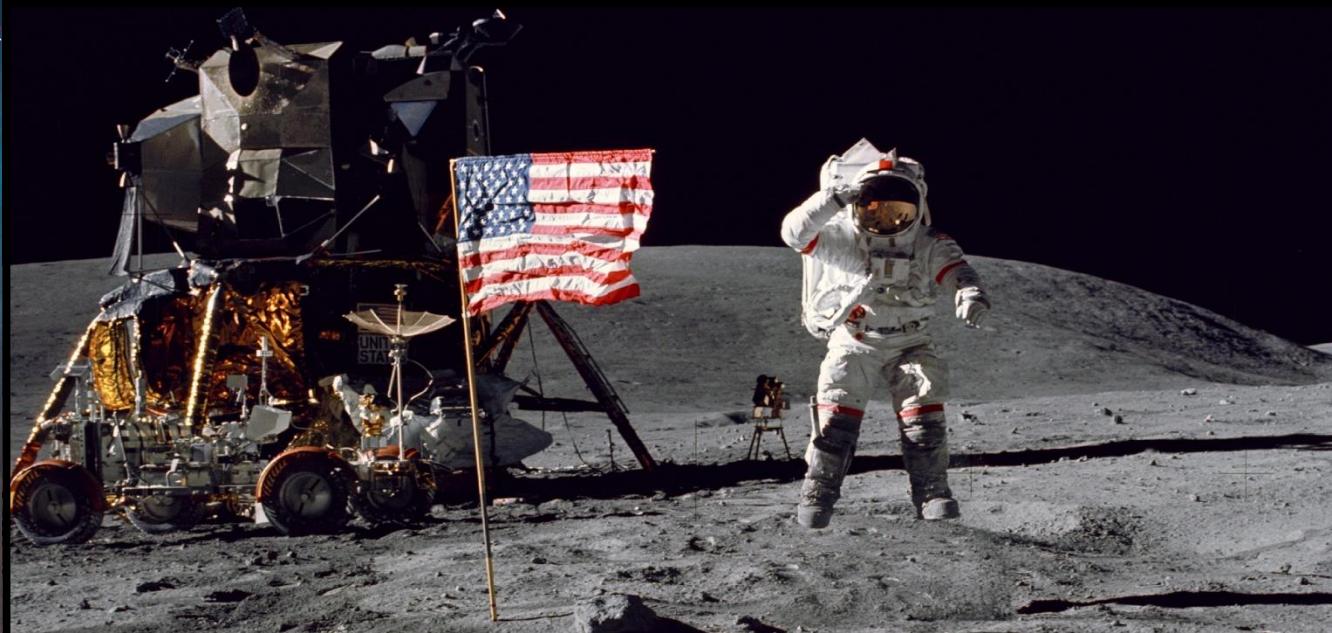


REACH
NEW
HEIGHTS

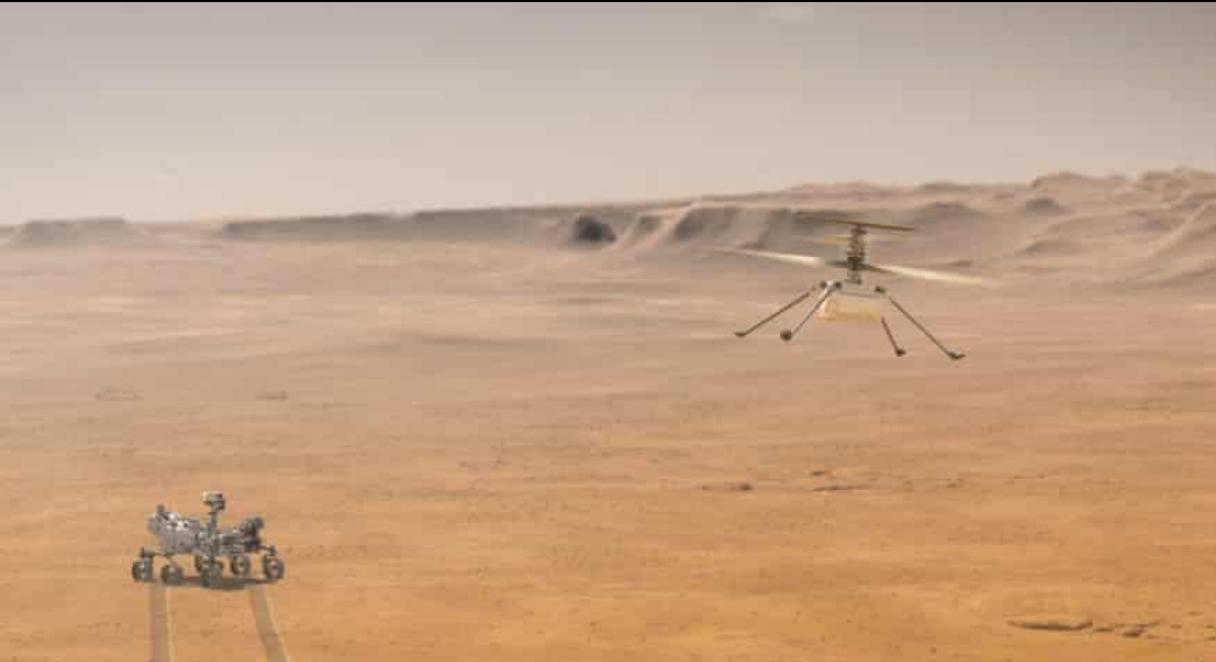
BENEFIT
ALL
HUMANKIND

REVEAL
THE
UNKNOWN

Then...

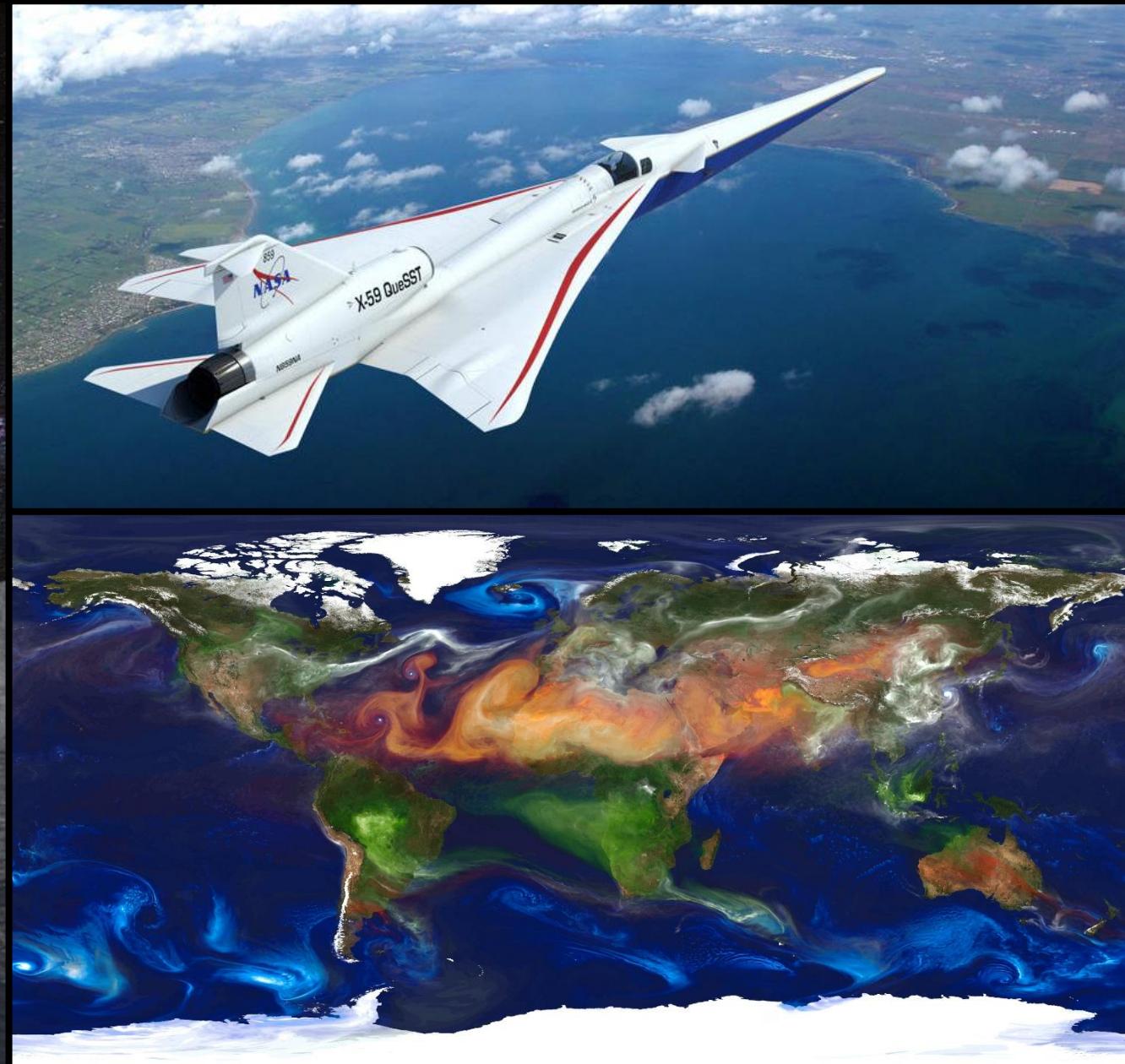
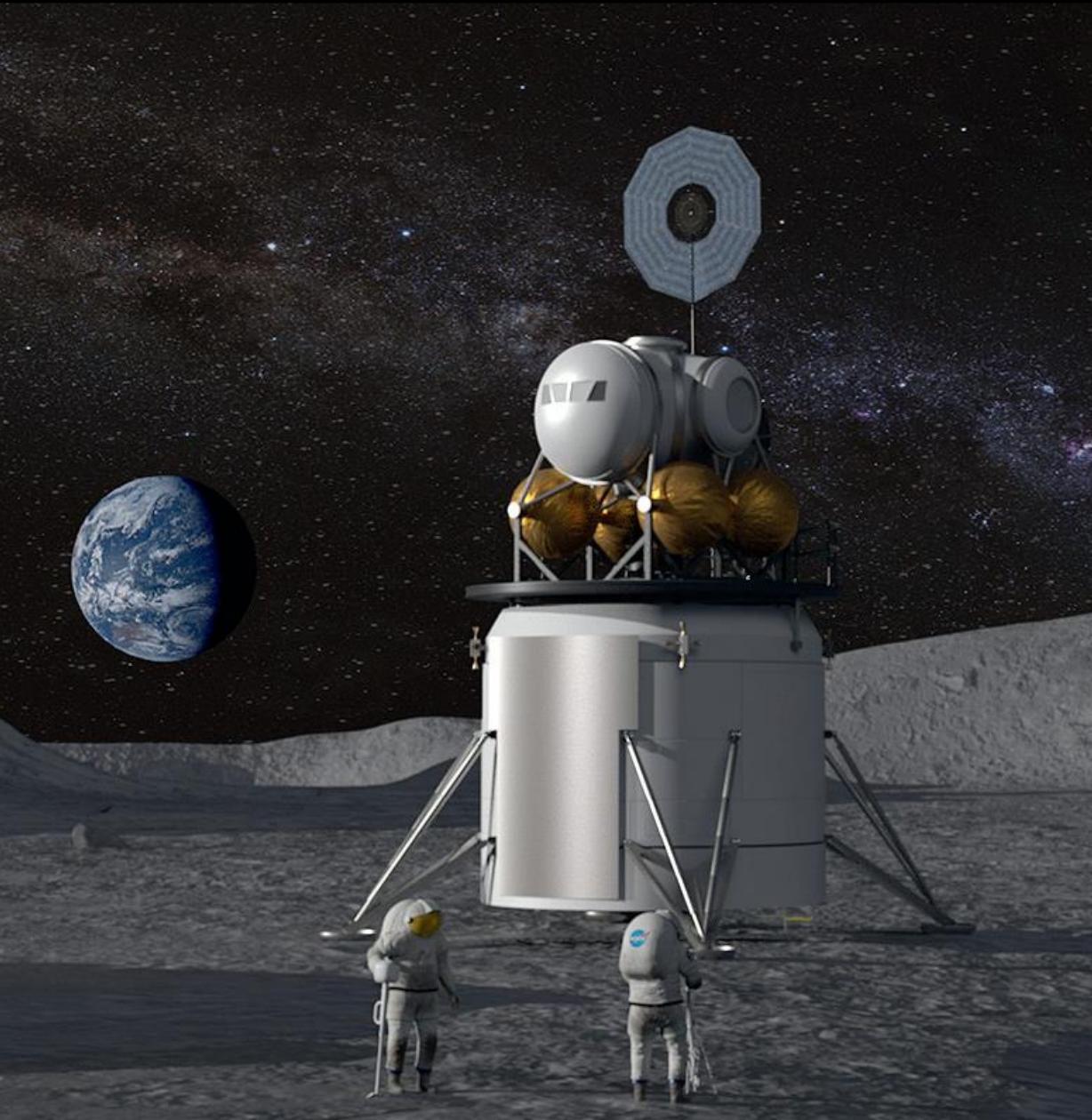


Now...





Next...

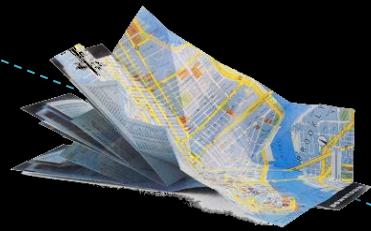


Digital Transformation

[dij-i-tl trans-fer-mey-shuhn] noun:

Employing digital technologies to change a process, product, or capability so dramatically that it's unrecognizable compared to its traditional form.

TRADITIONAL



DIGITIZED



TRANSFORMED

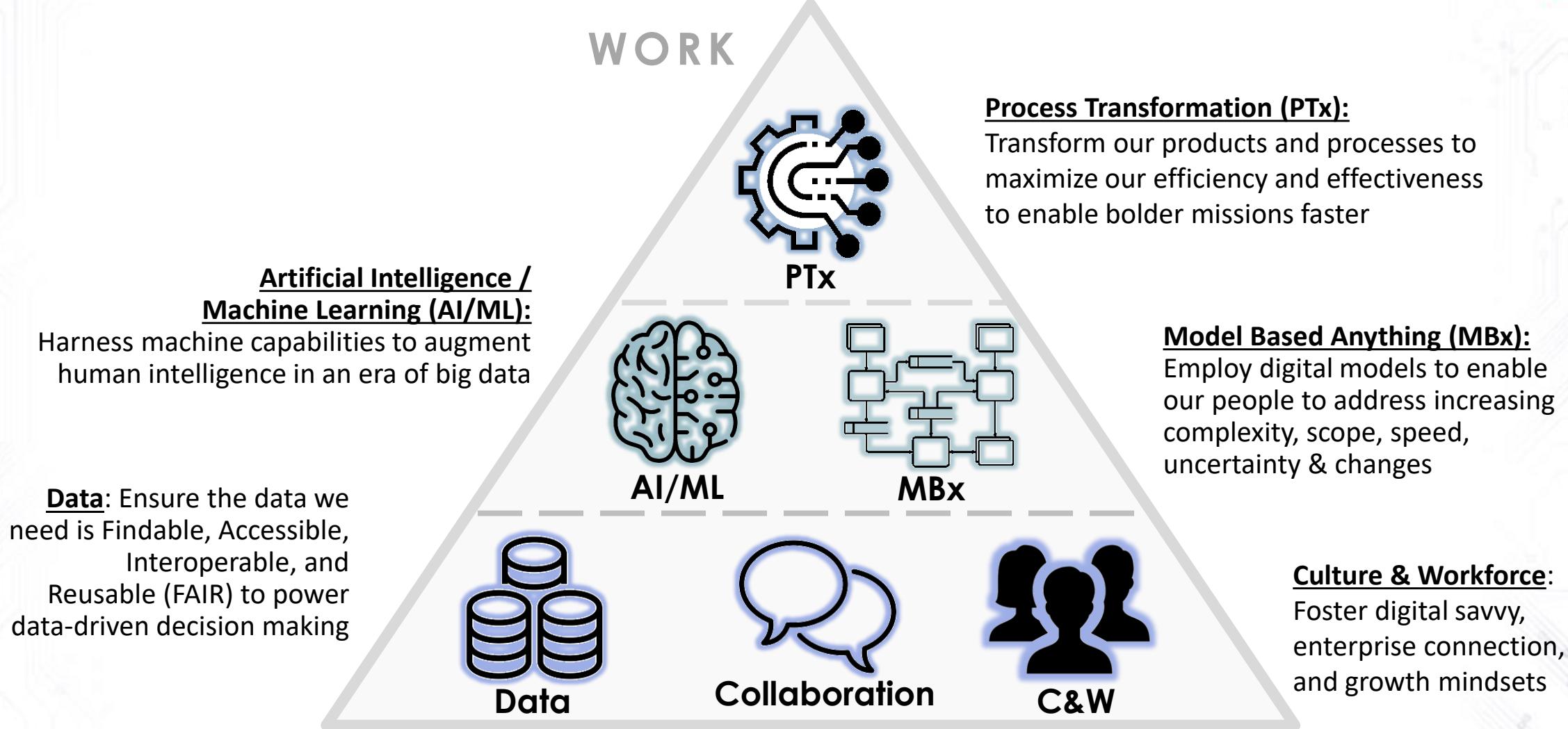


From Maps to Apps...

Digital Transformation
has already changed our world



Mobilize DT Foundational Elements



Artificial Intelligence / Machine Learning (AI/ML):

Harness machine capabilities to augment human intelligence in an era of big data

Data: Ensure the data we need is Findable, Accessible, Interoperable, and Reusable (FAIR) to power data-driven decision making

Process Transformation (PTx):

Transform our products and processes to maximize our efficiency and effectiveness to enable bolder missions faster

Model Based Anything (MBx):

Employ digital models to enable our people to address increasing complexity, scope, speed, uncertainty & changes

Culture & Workforce:
Foster digital savvy, enterprise connection, and growth mindsets

Collaboration:

Enable agile teaming via seamless, secure internal and external collaboration

WORKPLACE

WORKFORCE

Digital Transformation Acceleration

**Denotes future opportunity



Initial DT Foundational Elements

Data
Collaboration
Culture & Workforce
AI/ML
Model-Based Process

Evolving SMA/R&M Roadmap Elements

Policy Evolution
Product Evolution
Data/ Digital Threads
Outreach & Engagement (includes training)

NASA Coalition Projects/ Agency Anchoring Points

GSN/ Safety Case
Smart Reviews
Industry STD Digitization; EDP (F.A.I.R)
NASA Digital Academy

Achieve Desired Goals & Outcomes

Increased Decision Velocity

Risk Integration/ Robust Contextualization

Efficiency/ Maximize Resources

Align

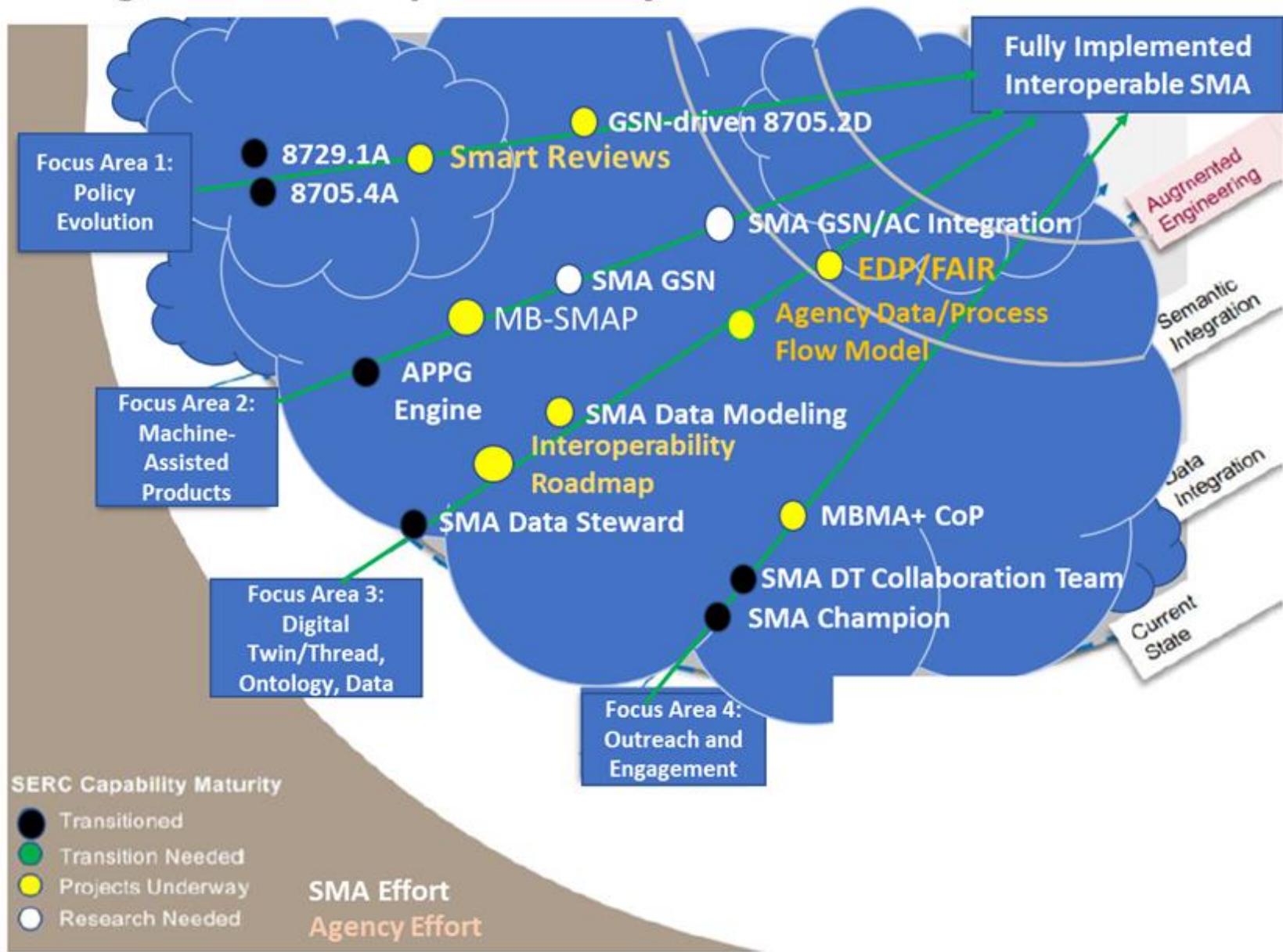
Leverage

Integrate

Engage

DT Strategies

Digital Roadmap for Safety and Mission Assurance



Adapted from Reference: Dr. Mary Bone, SERC

R&M DT Activities	Brief Description	Expected Benefits
Policy Evolution – GSN and Safety/Assurance Case framework	Use Goal Structure Notation and use of an Assurance Implementation Matrix to enable a Safety/Assurance Case framework across the life cycle.	<ul style="list-style-type: none"> - Enables digitization of goals and strategies and their decomposition into requirements and a Safety/ Assurance Case framework. - “Digitized” Knowledge enables re-use and eliminates “wheel re-invention when the wheel already works. - GSN/ Safety/ Assurance Case enables flexibility and innovation
Automated Program Plan Generator (APPG) Engine	Create authoritative “digitized” source of SMA related goals, objectives, and accepted stds (including framework to capture evolving innovative approaches to meet various goals and application needs)	<ul style="list-style-type: none"> - Rapid, machine-assisted, generation of SMA goals, strategies, and plans based on risk posture and project parameters. - Ability to measure and capture plan execution effectiveness using “digital threads” connected with corresponding operational missions. - Data enable AI/ML suggestions
Physics of Failure (PoF) Framework	Framework enabling AI/ML infusion, digital threads between analysis products (i.e., FMEA), failure models, source data, etc., across life cycle applications	<ul style="list-style-type: none"> - More rapid generation of physics-based reliability analysis - Enable AI/ML infusion to improve reliability estimation and fidelity. - Lessens reliance on document-centric handbooks to generate baseline reliability predictions.

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Thank you!





BACK-UP

Build DT Network

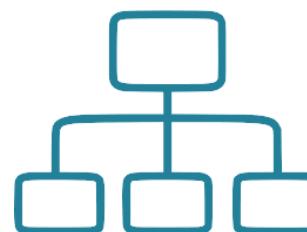
DT Users

NASA's employees, the ultimate internal customers of DT efforts, who play a critical role by being open to new ways of working and new opportunities created by the digital age



DT Champions

Senior Leaders from every NASA organization with authority and influence to adopt and align DT to enable organizational transformation goals

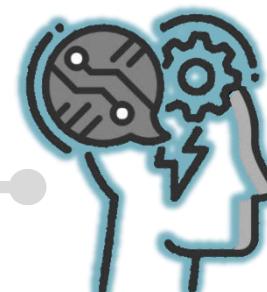


NETWORKED



DT Steering Committee

Chaired by the **Associate Administrator** and advised by representative senior leaders to ensure Enterprise DT enables federal & NASA priorities to be responsive to the American public



DT Foundations Teams

Early Adopters from across NASA who follow DT trends and propose/explore DT applications to attack working level barriers to accomplishing high-value work

DT Partners

External Organizations who have a shared interest and co-invest in enabling our aerospace community to work seamlessly together at the global pace of 21st Century business

Define DT Strategy

**1. Transform
the way we
WORK**

**2. Transform
the experience of our
WORKFORCE**

**3. Transform
the agility of our
WORKPLACE**

Improve complex decision making

Make partnering easier

Speed delivery

Increase interdisciplinary innovation

Increase public & stakeholder engagement

Enhance employee engagement

Expand employee capabilities

Maximize employee productivity

Improve operational readiness & agility

Make teaming easier

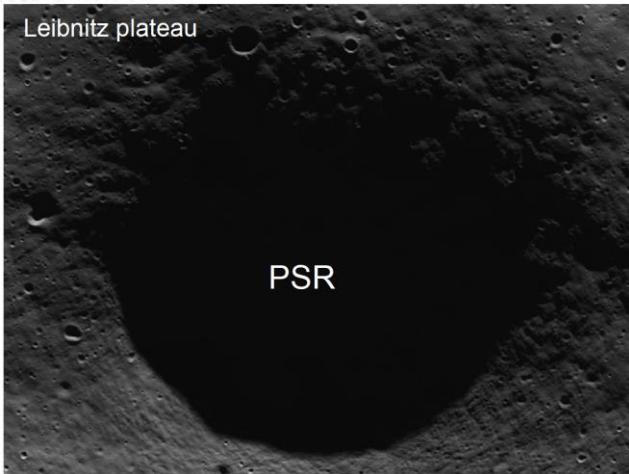
Rearchitect processes that work together

DT Coalition Approach

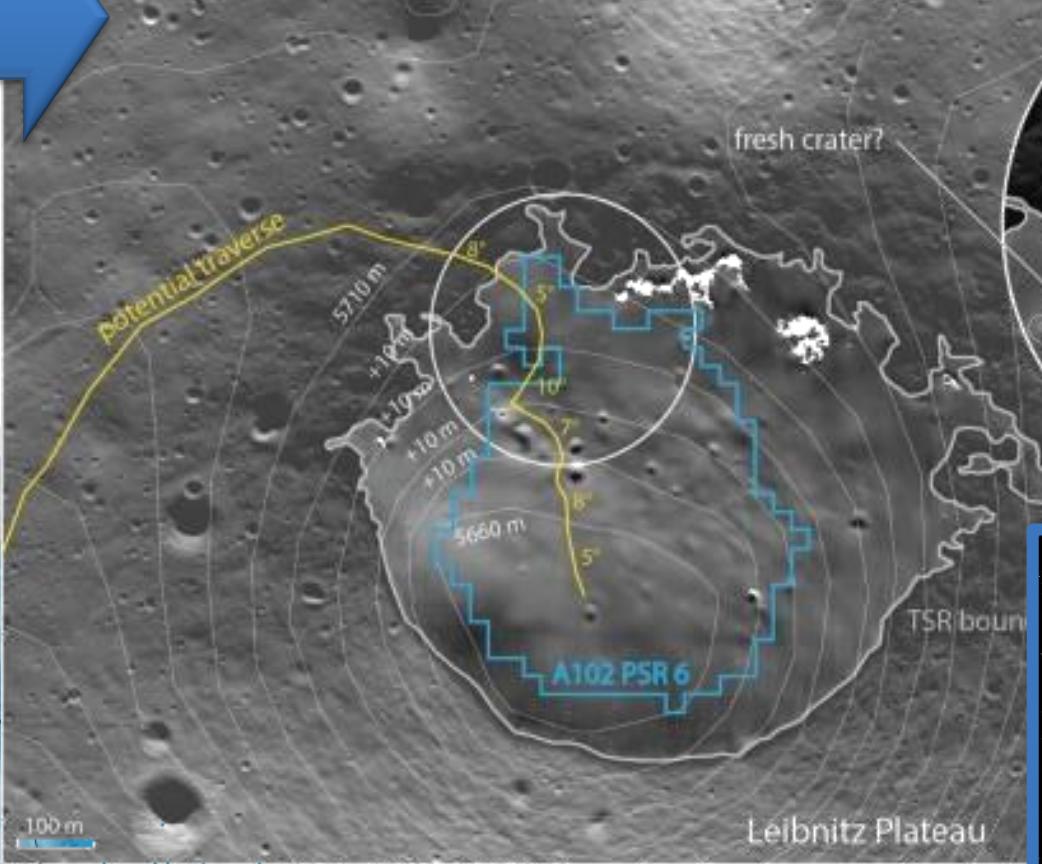
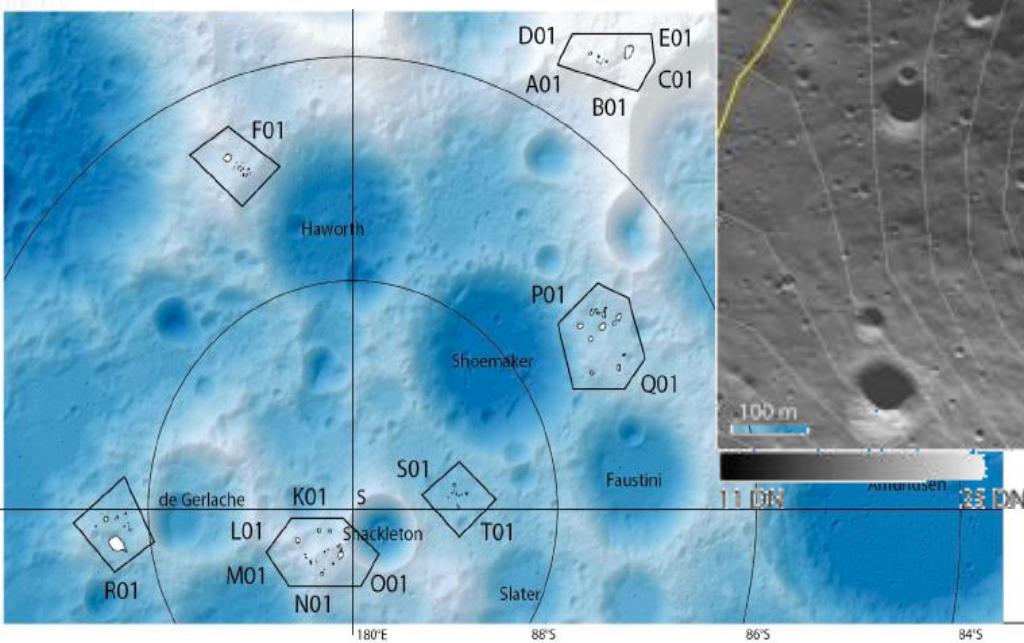
- **Conditions ripe for action:**
 - Orgs **already exploring digital solutions**
→ but constrained by **budget challenges**
 - **Limited visibility** into efforts across NASA
→ often **duplicate, fragmented and/or incompatible solutions**
- Decision to facilitate **Coalitions of the Willing:**
 - Identify **common challenges**
 - Co-invest in **shared solutions**
- **Benefits:**
 - Minimize disruption / resistance
 - Maximize engagement / solutions of interest



ML-powered Lunar Feature Detection



>4,000 high-res, low-noise images



20 Landing Sites



22TB data

<3m feature detection

Digital Academy & Swarm Innovation

Learning (SATERN) ▾

My Learning (SATERN) Supervisor Toolkit Skillsoft HRBP Learning Library Digital Academy

What is Digital Transformation?

NASA Digital Transformation



NASA's Digital Transformation dramatically enhances NASA's mission impact by reinventing mission and mission support processes, products, and capabilities enabled by an innovation culture, [NASA's Digital Transformation](#)

What is the Digital Academy?



What is Future of Work (FOW)?

Future of Work (FOW)



The future of work is ever evolving, but it is safe to say that for NASA that the future of work will have a hybrid work environment. The type of hybrid work environment

What is Model-Based Anything (MBx)?

Model Based Anything (MBx)



Modernizing NASA through model-based processes and tools

Core Courses and Resources

MBx Foundation Courses

Foundations of MBSE

What is Data Science: AIML?

Data Science: Artificial Intelligence Machine Learning (AIML)



Those Who Embrace Disruptors "Win"



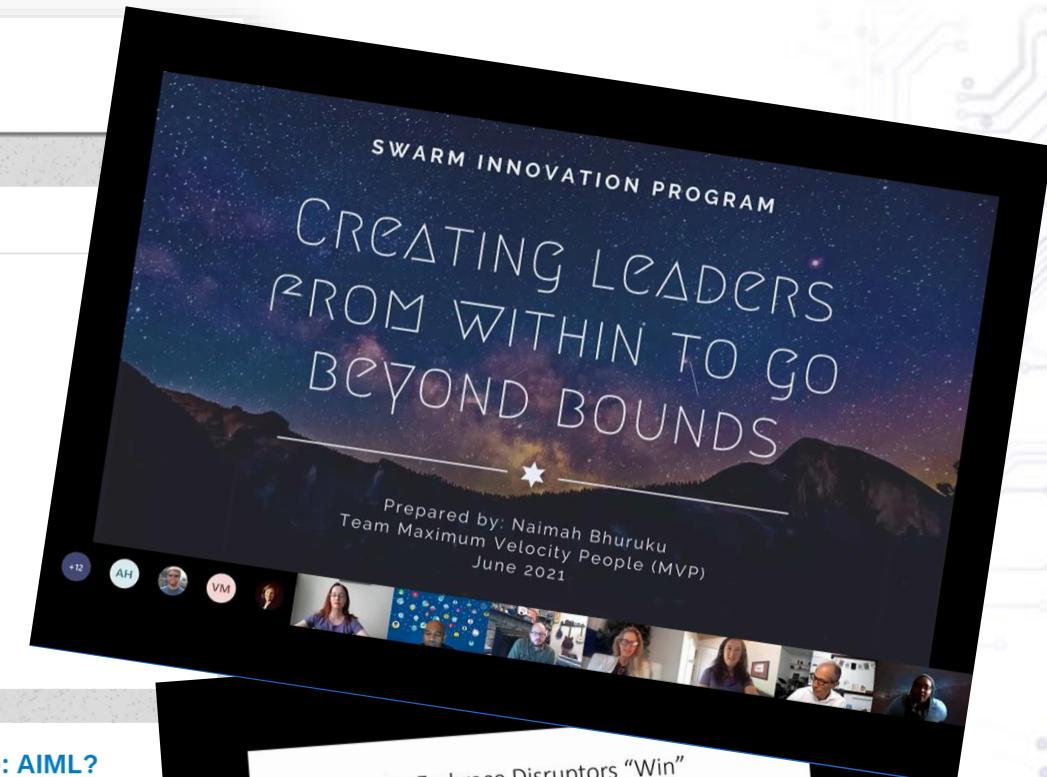
NETFLIX

• Video Rentals Worth \$8.4B 1994 Ignored Disruptors Filed for Bankruptcy in 2010

• Founded in 1997 Mailing DVD's Embraced Disruptors

Leader in Streaming Content Valuation over \$240B

AIML Sharepoint



COVID-19 Decision Lens

Explore / AGCY-EDL / Production / COVID-19 Executive Summary / COVID-19 Executive Summary

Information Page

Data from HHS and the NASA Contact Tracing and Tracking Team.

> 9/15/2021: HHS Data updates are currently delayed. Please refer to the Contact Tracking view for NASA tracing data.

> Data is displayed for the past two weeks only.

> Click on a center in the table to filter the dashboard by that center.

> "Active Onsite Cases" refers to cases found in the last three days in onsite NASA employees.

> "New Cases near NASA" refers to the daily count of new cases in counties around NASA centers (50 mile radius).

Latest COVID-19 Statistics Near NASA Centers

Data updated: 9/4/2021

Center Name	Onsite Cases Last 3 Days	Total Cases Last 14 Days
Ames Research Center	0	55,565
Armstrong Flight Research Center	0	54,438
Glenn Research Center	0	19,239
Goddard Institute for Space Studies	0	64,953
Goddard Space Flight Center	0	23,716
Headquarters	0	26,288
Independent Verification and Validation	0	8,744
Jet Propulsion Laboratory	0	77,381
Johnson Space Center	0	60,639
Kennedy Space Center	0	44,478
Langley Research Center	0	13,087
Marshall Space Flight Center	0	18,901
Michoud Assembly Facility	0	21,493

Active Onsite Cases are Trending Down.

Date	Cases
Aug 19	8
Aug 20	2
Aug 21	3
Aug 22	3
Aug 23	3
Aug 24	3
Aug 25	3
Aug 26	2
Aug 27	8
Aug 28	10
Aug 29	12
Aug 30	28
Aug 31	31
Sep 1	28
Sep 2	5
Sep 3	1

New Cases near NASA are Trending Upward.

Date	Cases
Aug 21	50K
Aug 22	220K
Aug 23	140K
Aug 24	160K
Aug 25	150K
Aug 26	280K
Aug 27	50K
Aug 28	100K
Aug 29	250K
Aug 30	140K
Aug 31	220K
Sep 1	150K
Sep 2	280K
Sep 3	50K

Positive Test Rate near NASA is Trending Down.

Date	Percent
Aug 26	11.0%
Aug 27	9.5%
Aug 28	8.5%
Aug 29	8.0%
Aug 30	8.5%
Aug 31	7.5%
Sep 1	7.0%
Sep 2	7.0%

Hospital Beds Usage Near NASA

Date	% Inpatient Bed Usage	% Total Bed Used	% ICU Bed Usage
Aug 21	75%	75%	75%
Aug 22	78%	78%	78%
Aug 23	77%	77%	77%
Aug 24	76%	76%	76%
Aug 25	77%	77%	77%
Aug 26	78%	78%	78%
Aug 27	77%	77%	77%
Aug 28	76%	76%	76%
Aug 29	77%	77%	77%
Aug 30	76%	76%	76%
Aug 31	77%	77%	77%
Sep 1	76%	76%	76%
Sep 2	77%	77%	77%

Active Onsite Cases at NASA

Information

Explore / AGCY-EDL / Development / Vaccination_Development_2021006_katya_adds / Vaccinations Summary

NASA Civil Servants Vaccinations View Updated 10/5/2021

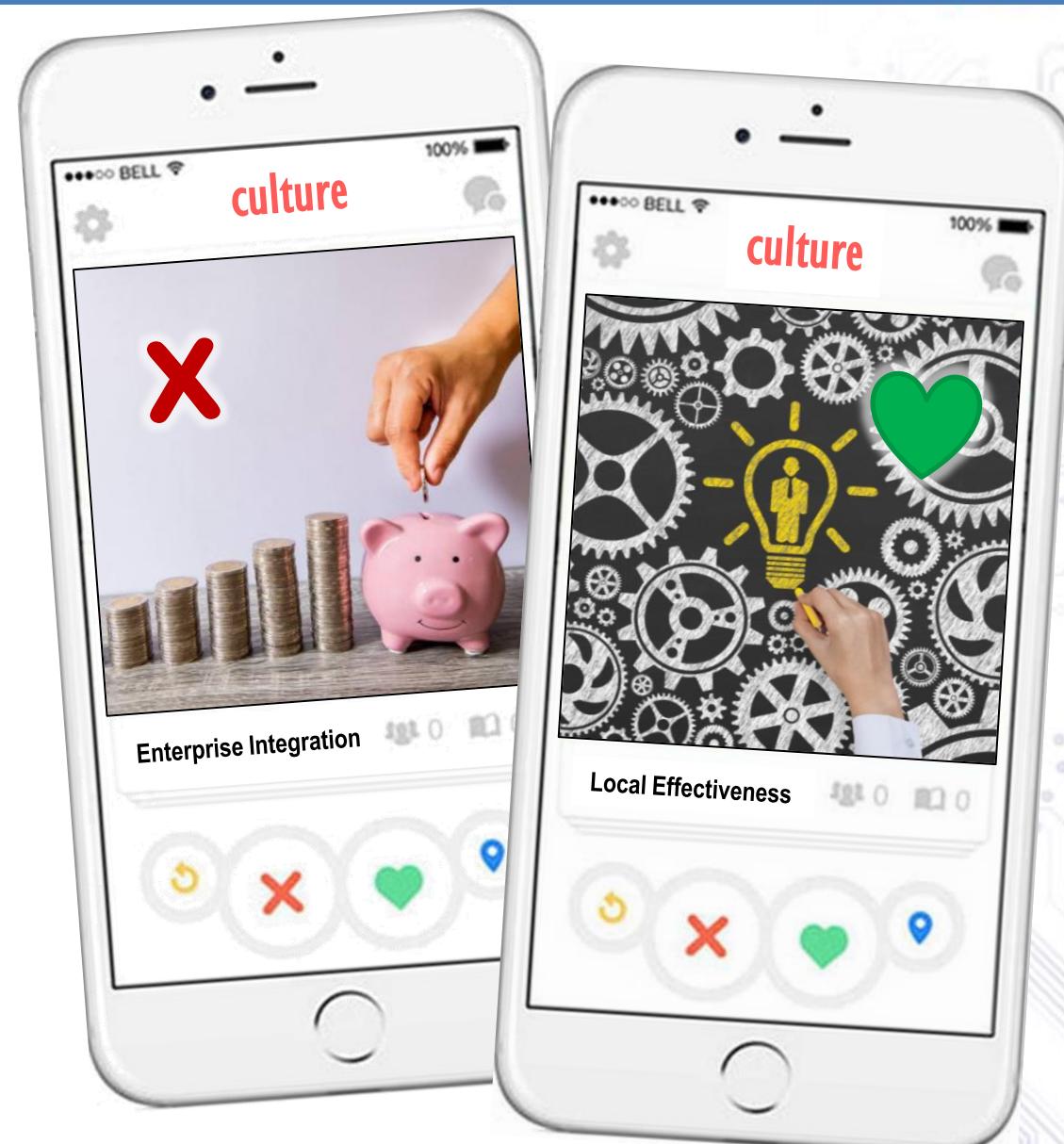
Per federal mandate, all civil servants and contractors must be fully vaccinated for COVID-19 as of January 1, 2021. An allowed exception is for medical contraindications. This view was developed with OCHMIS data.

Information

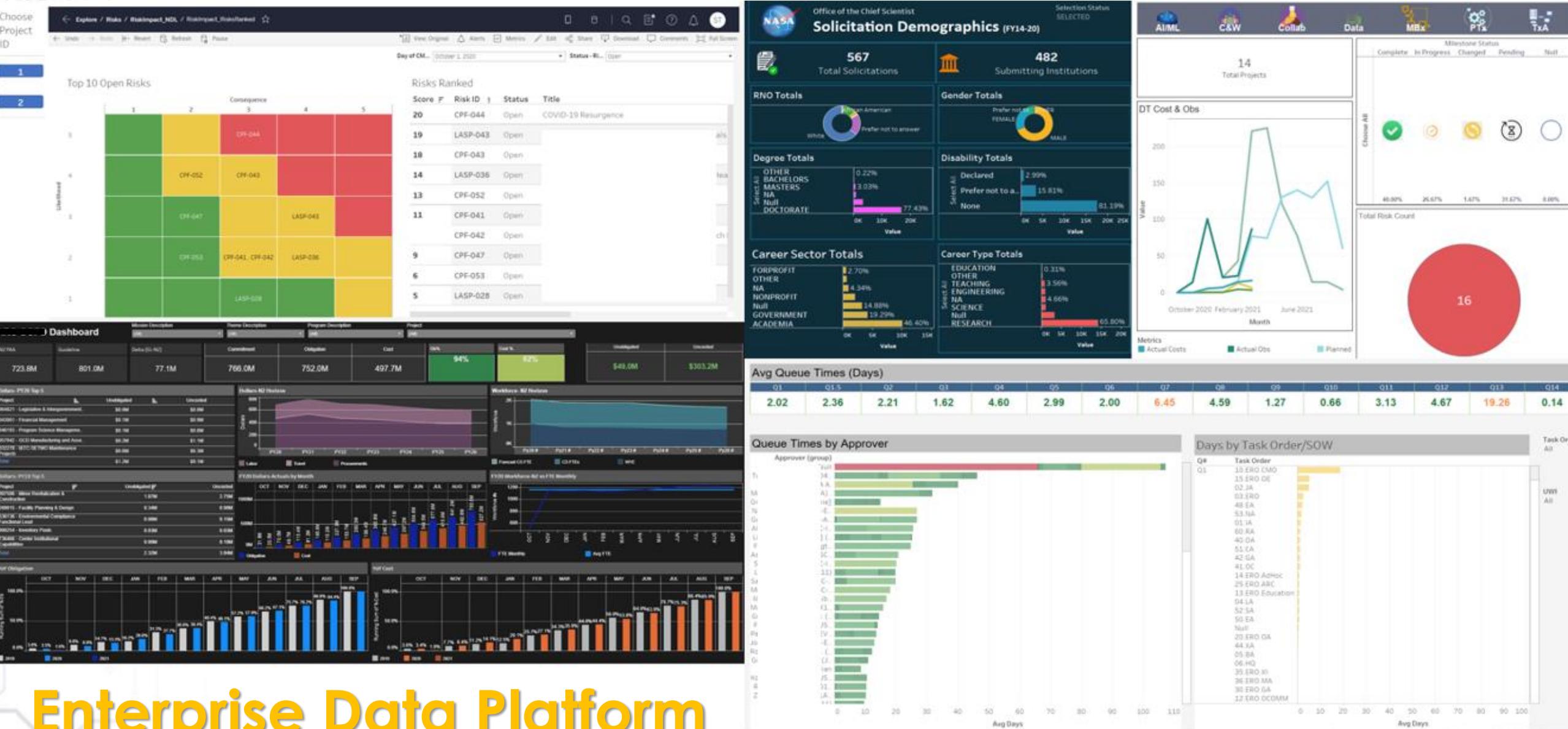
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Forge DT Coalitions

- Some **cultural skepticism** on enterprise solutions & willingness to co-invest
- Rally senior leader Champions around the transformation vision → established consensus on **pace of delivery** as top transformation challenge
- **Human Centered Design** sprints to dissect 5 Mission sponsored aspirations where we need to move faster → worked with users to identify key delays & engaged solution providers to develop **minimum viable products (MVP)**
- Secured **50/50 matching** with orgs & Enterprise DT on key MVP projects



Transform our Data



Enterprise Data Platform

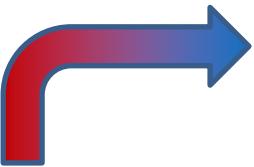
Transform our Engineering



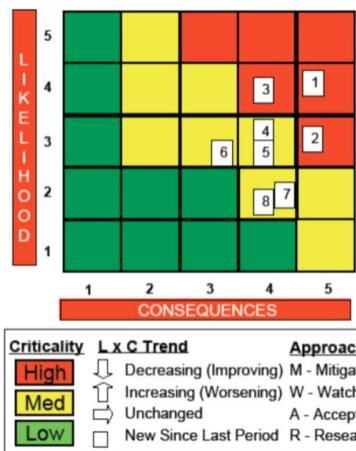
Digital Engineering Environment

Transform our Reviews

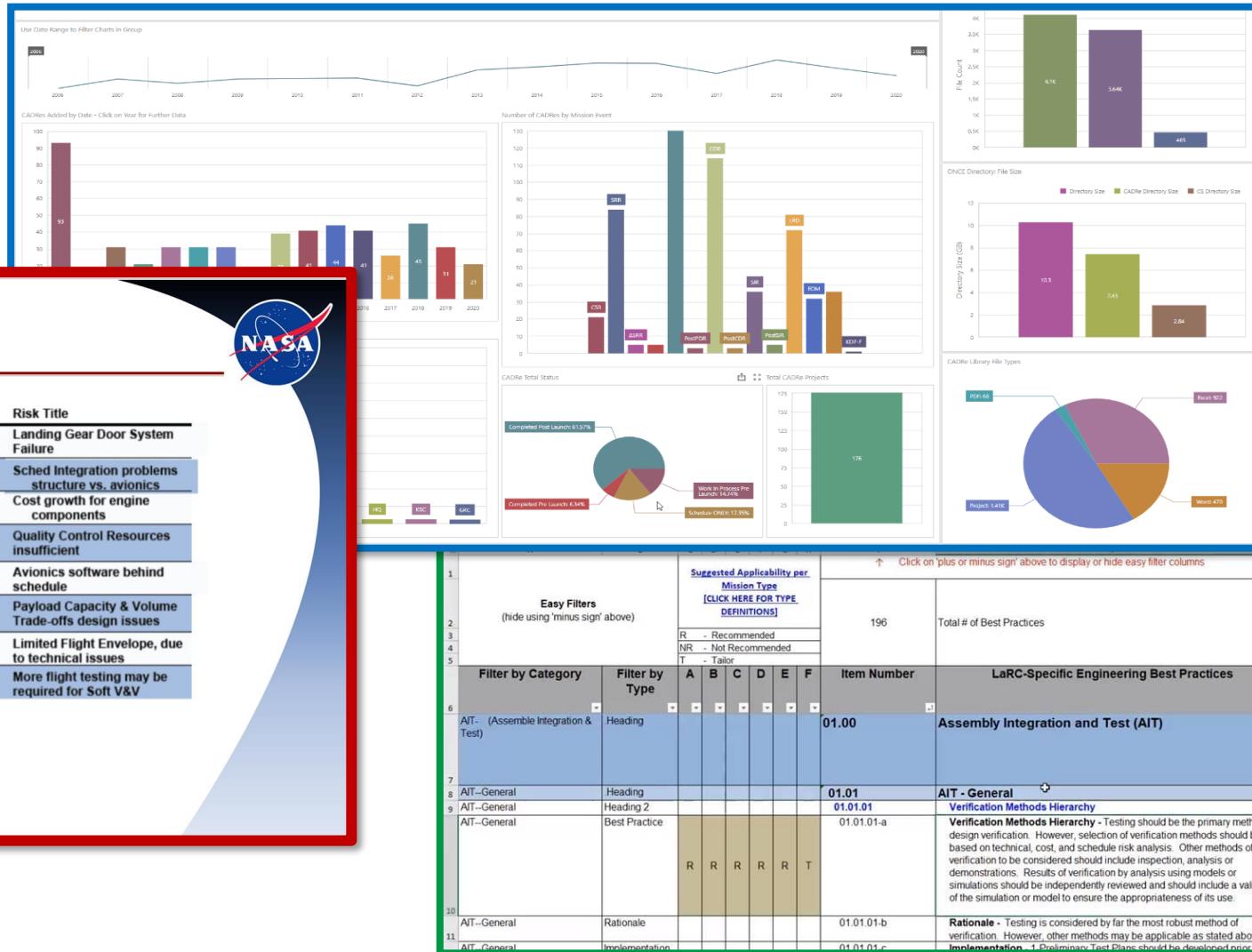
2D Charts



Risk Assessment



Rank & Trend	Risk ID	Approach	Risk Title
1	DFRC-34	R	Landing Gear Door System Failure
2	DFRC-12	M	Sched Integration problems structure vs. avionics
3	DFRC-07	W	Cost growth for engine components
4	DFRC-24	A	Quality Control Resources insufficient
5	DFRC-01	W	Avionics software behind schedule
6	DFRC-11	R	Payload Capacity & Volume Trade-offs design issues
7	DFRC-04	R	Limited Flight Envelope, due to technical issues
8	DFRC-02	R	More flight testing may be required for Soft V&V



Live, drill-down
Dashboards
w/analytics



Lessons Learned Bot Results

Related Documents

Document Abstracts

Smart Reviews

AI-powered PM Digital Assistants

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